A Brief Guide

Fire Protection System Overview

Some building owners view fire protection systems as a cost without a direct return on investment, unless they have experienced a previous fire event or truly understand the associated risks. Similarly, some design team members might view fire protection as a required inconvenience and do not want to spend time or effort beyond the simplest path to meet minimum code requirements.

The maintenance of fixed automatic fire extinguishing systems in an efficient state and familiarization with all details of operations is essential if the maximum benefit is to be derived in the emergency of an outbreak of a fire. A major fire can quickly bring a business to a standstill with loss of lives, loss of goods, equipment, and building damage, smoke damage, loss of reputation, loss of customers due to business standstill and subsequent downtime are just some of the outcomes when fires are not quickly contained. With the right solutions in place, the risk of minor mishaps or serious incidents can be averted or reduced. Designing a fire protection system requires expertise in fire behaviour, fire spread rate and fire protection engineering science. The design of any fire-protection system is an exact engineering science that takes into account a building's use, occupancy, building height, storage height, storage configuration and even its other installed systems. Planning for fire protection involves an integrated approach in which system designers need to analyze building components as a total package. In most cases, the analysis needs to go beyond basic code compliance and the owner's minimum legal responsibilities for providing protection.

A fire must be detected at the earliest stage to reduce the risk of facility and stock loss and also to increase reaction time before the fire spreads to uncontrollable conditions.

Reliable, very early warning system minimises the likelihood of product loss, facility damage and operational/supply downtime. The design requirements and the ease of servicing the fire detection system significantly reduce the long term costs (i.e. lifecycle costs) of the detection system.

International standards and codes of practice should always be taken into consideration. Ensure your fire alarm is installed in accordance with **BS 5839** standards or **SANS**.

The spacing of smoke detection positions is dictated by international standards. The availability of drawings allows detection to be placed where it is required, as well as complying to the code requirement. Alarm levels and appropriate levels of response are determined by each individual application environment.

Ability to provide performance-based solutions allows for the requirement to install the system to meet an individual building specification.

Performance-based design determines the best fire protection system by assessing the environmental risks at the concept design stage. Traditional prescriptive codes and standards have proven to provide an appropriate level of fire protection with a reasonable safety margin. However, as tools and industry expertise continues to develop, the fire protection strategy in many installations is being designed from a risk and performance-based design approach. This may include the use of computerised modelling tools and analysis of on-site tests (i.e. smoke testing) to determine airflows, fire loading, ventilation, ignition sources and other physical conditions that may affect the likely development of a fire.

Fire Detection & Alarm System Overview

Fire detection systems are designed to discover fires early in their development when time will still be available for the safe evacuation of occupants. Early detection also plays a significant role in protecting the safety of emergency response personnel. Property loss can be reduced and downtime for the operation minimized through early detection because control efforts are started while the fire is still small. Most alarm systems provide information to emergency responders on the location of the fire, speeding the process of fire control.

To be useful, detectors must be coupled with alarms (Figure 1). Alarm systems provide notice to at least the building occupants and usually transmit a signal to a staffed monitoring station either on or off site. In some cases, alarms may go directly to the fire department, although in most locations this is no longer the typical approach.

Figure 1

These systems have numerous advantages as mentioned above. The one major limitation is that they do nothing to contain or control the fire. Suppression systems such as automatic sprinklers act to control the fire.

They also provide notification that they are operating, so they can fill the role of a heat detection-based system if connected to notification appliances throughout the building. They will not, however, operate as quickly as VESDA systems. This is why facilities where rapid notice is essential, even when equipped with sprinklers, still need detection and alarm systems.

The most basic alarm system does not include detection. It has manual Call Point (Figure 2) and sounds only a local alarm.

Figure 2

This level of system is not what is typically used; it relies on an occupant to discover the fire, which can cause a significant delay. The more quickly you want to be notified of the fire, the more costly the system you must install. Speed of detection is expensive.

The slowest system to detect a fire is a heat detector (Figure 3), which is also the least expensive. An air-aspirating smoke detection system provides the most rapid indication of fire, but these Systems are five to ten times as expensive.

Figure 3

Where to Start When Choosing a System

The type of fire detection and alarm system used in your facility should be based upon your fire safety objectives. These objectives flow from a risk assessment of your facility and operation. Your tolerance for risk and how much you can afford to lose is an important part of this process.

The issues within a hospital are not the same as they are in a warehouse. In a facility where life safety is the major concern, such as hospitals where patients may not be able to evacuate on their own, early warning is essential.

Dormitories, hotels, and other facilities where occupants may be sleeping when a fire starts also requires a system that provides more rapid notification.

In a warehouse, where the occupants will be awake and aware and there will most often be fewer of them, the alarm system often does not need to provide notice as early. In a generally unoccupied structure where life safety is not a major issue, detection of a fire can be slower without significantly increasing risk.

When selecting a system, you also must consider the ongoing commitment that will be required over the life of the system. Inspection, testing, and maintenance requirements for these systems are extensive. Meeting these requirements over the life of a system usually will cost more than the original installation.

Figure 4

Initiating devices are elements of the system that originate a signal. Manual Call Points, smoke detectors (Figure 4), and supervisory devices are included in this group of components.

A manual Call Point is essentially just a switch that activates the alarm system when operated by a building occupant. Call Points should be positioned so they are easy for occupants to find. They are typically located along routes of travel that would be used while exiting the building.

Ionization smoke detectors (the most common in home use) detect the particles in smoke. As smoke passes through the chamber, the particles are ionized. These particles may then be detected by charged plates in the detector. Smoke detectors are also available in combination with a heat detector (Figure 5).

Figure 5

The beam type detector (Figure 6) operates when the beam is interrupted by obscuring smoke between the laser emitter and receiver. These detectors are most often used in areas of large open spaces.

Figure 6

An air sampling detection system uses tubing placed throughout the protected area. The tubing has small holes spaced out along the length of the tube and air is constantly drawn into the unit, which can detect extremely low levels of combustion products.

Supervisory and Notification Devices

Numerous supervisory devices can be connected to the fire alarm control panel.

Systems may be addressable (Figure 7) or nonaddressable (Figure 8). In the first type, all of the detectors on the system have a unique digital identifier. The fire alarm control panel can communicate individually with each device. In non-addressable systems, detectors may be divided into zones based on all of the detectors being on the same pair of wires, but the control panel cannot determine any information about an individual detector.

Figure 7

Figure 8

Addressable systems offer several advantages. The first is that a specific indication of the location of activation is available during a fire. (Would you rather know that a detection has occurred somewhere in the west wing of your building or that it has occurred in office number 103? The latter is clearly more informative.) This specific location capability is also part of the second major advantage of these systems: trouble signals can specifically identify the component with a problem. If a single detector fails, for example, an addressable system will provide a trouble signal that indicates the specific detector. In non-addressable systems, the zone will be identified, but a repair person will have to check each detector in that zone to determine which one is not working.

Notification appliances are the audible, visual strobe, and other devices located throughout the facility that warns occupants when the system has detected a fire. Horns, strobes (Figure 9), combination units and bells are examples of these devices. Fire alarm control panels often have features available that allow alarms to be activated in selected locations within the facility based upon the location of the detector that activates.

Figure 9

This feature can be used to permit staged evacuations, for example. Alarms should be supplemented with communications devices that allow you to provide specific information and instructions to building occupants. People tend not to always respond as they should when a fire alarm sounds. An emergency voice communications system can significantly improve response of your occupants.

Fire Alarm Life Expectancy

It is expected that the equipment manufacturer would be in the best position to state the expected lifespan of their particular product. It is common practice for the manufacturer to have an *obsolescence* policy regarding spares and assistance for maintenance; nevertheless, this is a separate and solely commercial issue.

Regardless of whether a manufacturer endorses a guideline lifetime, an end user is not expected to upgrade a system just because it has arrived at this date, the primary concern is the system reliability. While system components carry on and prove functional during routine maintenance, there's no compelling need to change them. On the other hand, where faults and failures seem to be age connected, especially, when they are getting more regular, this may suggest a time to upgrade the system. Where a faulty component could lead to a prolonged downtime or call for a major *refit* because they are no longer immediately replaceable, it might be wise to think about an organized replacement.

It is important to keep in mind that a badly maintained *fire alarm* system which is giving false alarm signals might result in a loss of belief in the system to the degree that it may become ineffective, and this would not be in accordance with the requirements of the fire safety legislation. Generally speaking, it is believed that manual call points and heat detectors are sturdy equipment that would not be likely to deteriorate even over long periods, greater than 10 years. However, smoke detectors have got a restricted life, and manufacturers will state a suggested replacement period.

Other components may also have a determined lifetime, and manufacturers will offer a recommendation. BS *5839-1,* 25.4 b*)* advises that the batteries employed for a standby supply in a *fire alarm control panel,* must be of a type having a life span of a minimum of four years. To assist keeping track of these details the model for a system *logbook* provided in BS *59839-1, Annex* G contains a section to list the disposable element's replacement time frames.

The primary impact on the life span of nearly all detectors would be the environment: A smoke detector in a really clean, sterile environment will most likely keep working for a very long period of time, on the other hand; in a dusty and unclean environment, the detector will have a comparatively limited life.

The life expectancy of alarm equipment, *such as sounders,* would be determined by the amount of hours of operation and this is especially the case for mechanical bells or visual alarm equipment, which uses discharge tubes.

The occasional brief operation during routine testing will have little impact on the life span of a device, but continuous operation for prolonged periods could cause damage to some equipment. This may lead to a reduced or abnormal output or decreased light output. If the *fire alarm* system has been left in a fire activation for an extended time in a vacant building, a *retest* of sound levels could be advisable.

System Maintenance

Adequate maintenance of fire protection systems is as critical as the original decision to install them. Because fire detection and alarm systems aren't employed on a regular basis, their condition of readiness isn't really clear. However, when these systems are called on to operate, there is usually an unexpected emergency taking place and therefore, it is vital that the system works correctly first time. There is no time to perform maintenance or repairs during the emergency.
Addressing false alarm problems also forms an element of maintenance programs as they not only waste fire brigade time, but also significantly affect the effective working time of the company and service organisations e.g. hospitals. They also reduce the confidence of building occupiers on the importance of fire alarm signals.
Ensure your fire alarm is serviced and maintained in accordance with BS5939 section 6: 44

Conclusions

Remember – fire prevention is imperative, and can save lives and property. A fire suppression system is designed to protect your business, and should be installed to provide a safeguard in the event of a fire. When it comes to fire safety, choosing the best fire suppression specialist doesn’t have to be a chore. In fact, there are many experienced companies that specialize in the sales and installation of these equipment. However, you will need to do your research to ensure that you receive good customer service and the best value-for-money. Fires do not happen all the time, so it is difficult to know whether your installed system will work in the event of a fire. Your system must be designed to meet some recognized international standards. Do not allow guess work when it comes to fire protection systems.

Types of Fire Alarm Systems

All Fire Alarm Systems essentially operate on the same principle. If a detector detects smoke or heat or someone operates a break glass unit (manual break point), then alarm sounders operate to warn others in the building that there may be a fire and to evacuate. It may also incorporate remote signaling equipment which would alert the fire brigade via a central station.

Fire Alarm Systems can be broken down into four categories:

- Conventional
- Analogue Addressable
- Addressable
- Wireless Systems

Conventional Fire Alarm System

In a Conventional Fire Alarm System, a number of call points and detectors are wired to the Fire Alarm Control Panel in Zones. A Zone is a circuit and typically one would wire a circuit per floor or fire compartment. The Fire Alarm Control Panel has a number of Zone Lamps. The reason for having Zones is to give a rough idea as to where a fire has occurred. This is important for the fire brigade and of course for the building management. The accuracy of knowing where a fire has started is controlled by the number of Zones a Control Panel has and the number of circuits that have been wired within the building. The Control Panel is wired to a minimum of two sounder circuits which could contain bells, electronic sounders or other audible devices. Each circuit has an end of line device which is used for monitoring purposes.

Addressable Systems

The detection principle of an **Addressable System** is similar to a Conventional System except that the Control Panel can determine exactly which detector or call point has initiated the alarm. The detection circuit is wired as a loop and up to 99 devices may be connected to each loop. The detectors are essentially Conventional Detectors, with an address built in. The address in each detector is set by dill switches and the Control Panel is programmed to display the information required when that particular detector is operated. Additional Field Devices are available which may be wired to the loop for detection only i.e. it is possible to detect a normally open contact closing such as sprinkler flow switch, or a normally closed contact opening. Sounders are wired in a minimum of two sounder circuits exactly as a Conventional System. Loop Isolation Modules are available for fitting on to the detection loop/loops such that the loop is sectioned in order to ensure that a short circuit, or one fault will only cause the loss of a minimal part of the system.

Analogue Addressable Fire Alarm Systems

Analogue Addressable Fire Alarm Systems are often known as Intelligent Fire Alarm Systems. There are several different types of Analogue Systems available which are determined by the type of protocol which they use. The bulk of standard Analogue Detectors available are fairly stupid as the Detectors can only give output signals representing the value of detected phenomena. It is left up to the Control Unit to decide whether there is a fire, fault, pre-alarm or other. With a true Intelligent Analogue System each detector effectively incorporates its own computer which evaluates the environment around it, and communicates to the Control Panel whether there is a fire, fault or the detector head needs cleaning. Essentially Analogue Systems are far more complex and incorporate far more facilities than Conventional or Addressable Systems. Their primary purpose is to help prevent the occurrence of false alarms. With the Analogue Addressable System, up to 127 input devices i.e.: Smoke Detectors, Call Points, Heat Detectors, Contact Monitors and other interface devices may be wired to each detection loop. In addition to the 127 Input Devices, up to 32 Output Devices such as Loop Sounders, Relay Modules and Sounder Modules may be connected. Analogue Systems are available in 2, 4 and 8 loop versions which means large premises can be monitored from one single panel. Isolator units should be connected between sections of detectors as described for Addressable Systems.

Wireless Fire Alarm System

Wireless fire alarm systems are an effective alternative to traditional wired fire alarm systems for all applications. They utilize secure, license-free radio communications to interconnect the sensors and devices (smoke detectors, call-points, etc.) with the controllers. It is a simple concept, which provides many unique benefits and is a full analogue addressable fire detection system without the need for cable.

System Design

Before starting, the designer will need to ensure that certain information is available. This may be given in the specification or it may have to be obtained by consultation.

Points to consider

- The type of system required i.e. L1, L2, L3 etc. and where appropriate, parts of the premises to be covered.
- The action to be taken in the event of fire
- Whether other occupants of a multi occupancy building will be affected
- Whether other work is to be done at the same time. If so then consultation with other contractors may be required.
- A Method of calling the Fire Brigade
- Whether the type of occupants or activity in the building will require a greater provision of Manual Call Points than normal
- A likely attendance time of the Fire Brigade

Control of Indicating Panels

Control and indicating equipment performs three principal functions, namely:

- Automatic monitoring and control of circuits external to the equipment, such as fire detection and fire alarm device circuits and supply of power to these circuits
- Indication of fire signals, fault signals and their location
- Manual control to facilitate actions such as testing, disablement of devices, triggering of fire signals, silencing of audible fire warnings and resetting the system after a fire signal

Panels are fully specified in British Standards. This requires that circuits are monitored continuously and that both audible and visual indication is provided for fault and fire alarm conditions. Further requirements include that alarm sounders may only be silenced manually, after which the control panel must provide audible and visual signals until the system is reset. Silencing of alarm sounders must not prevent the alarm being raised in other zones. It should be noted that the standards require all fault/alarm indicator lamps to be in duplicate or a single lamp with audible signal of lamp failure. Control and indicating panels may include facilities for operation of ancillary services such as fixed fire extinguishing, door closing etc.

The equipment should normally be sited in an area of low fire risk and on the ground floor by the entrance used by the Fire and Rescue Service and preferably viewable from outside of the building. It should be located in an area common to all building users and where automatic detection is in use, the Control Panel should be in a protected area. An alarm sounder should be sited next to the Control Unit, but not too near the telephone position. A suitable zone chart of the building should normally be installed adjacent to the Control Panel.

Points to consider

- Number of zones required
- Surface or flush mounting
- Maximum alarm load per alarm zone
- Automatic system, compliance with British Standard
- Manual system compliance with British Standard
- Maximum current per detector zone
- Maximum detectors per zone
- Open, closed or fault monitored system
- Single or two stage alarms
- Provision for connection to remote manned center
- Provision for conduit and wiring compatible with building conduit and wiring system
- Provision for operation of ancillary services

Detector Heads

These can be divided into four main types Heat detectors, Smoke detectors, Carbon Monoxide detectors and Multi sensors detectors.

Heat detectors

Heat sensitive point detectors

Point detectors can again be subdivided to a further two types.

1. Fixed temperature which will operate when it is exposed to a pre-determined temperature. Normally fixed temperature detectors employ a fusible alloy element which must be replaced after the detector has operated. Different temperature rated elements are available to take account of varying ambient air temperatures.
2. The second type operates on the rate of temperature rise. The rate of rise temperature detector may also include a fusible element for fixed temperature operation.

Both types are suitable for inclusion in open, closed or line monitored systems.

Linear detectors

These can take the form of a heat sensitive cable which will operate, at a predetermined temperature, as an open circuit device. Melting of the cable insulation provides a short-circuit between conductors. After operation the destroyed length of cable must be replaced. Linear detectors may be used in large areas such as warehouses. Alternative types of linear detector exist including the heat pneumatic operating on the rate of rise principle.

Points to consider

- Open, closed, fault monitored circuits
- Temperature setting for fixed temperature fusible elements
- Spare fusible elements
- Surface or flush mountings
- Temperature setting for fusible elements in the rate of rise detection., if included
- Mounting height
- Spacing to manufacturer’s recommendations
- Rate of rise detectors located in positions where abnormal increase in temperature is likely, e.g. space heating equipment, industrial processes

Smoke Detectors

There are three basic types operating by ionization, light scattering and light obscuring.

Ionization

These generally contain two chambers. One is used as a reference to compensate for changes in ambient temperature, humidity or pressure. The second contains a radioactive source, usually alpha particle, which ionizes the air passing through the chamber where a current flows between two electrodes. When any of the products of combustion enters the chamber the current flow decreases. This drop is used to initiate an alarm.

Light obscuring

In the obscuring type the smoke interferes with a light beam between a light source and photo cell, the variation in photo cell output being used to initiate an alarm. This type of detection can be used to protect large areas with the source and photo cell positioned some distance apart.

Light scattering

The light scattering detector operates on the Tyndall effect, a photo cell and light source are separated from each other by a darkened chamber such that the light source does not fall on the photo cell. The passage of smoke into the chamber causes the light from the source to be scattered and fall on the photo cell, the cell output being used to initiate an alarm.

The light scattering and light obscuring detectors both, detect visible smoke. The ionization detector and light scattering detector are normally each a single unit suitable for BESA conduit box mounting. In some models the smoke detector head is attached to the main body by a bayonet fixing for easy removal for maintenance or replacement. It should be noted that some detectors are suitable for two-wire circuits whereas others require three or four wire connections. Smoke detectors require a continuous power supply. Under quiescent conditions they draw a current of some 100 micro amps, and under alarm conditions, some 45 milliamps. This needs to be borne in mind when sizing the power supply. Smoke detectors generally operate on 24 D.C. Refer to British Standard Codes of Practice and manufacturers literature for information regarding the positioning of smoke detectors. Detectors are not suitable for positioning in kitchens, near fireplaces or areas with excessive exhaust fumes, or within 2m of air supply ducts or diffusers.

Carbon Monoxide detector

CO fire detectors are electronic detectors used to indicate the outbreak of fire by sensing the level of carbon monoxide in the air. Carbon monoxide, usually known by its chemical formula CO, is a poisonous gas produced by combustion. They are not the same as CO detectors used for home safety which are used to protect residents against carbon monoxide produced by incomplete combustion in appliances such as gas fires or boilers.

CO fire detectors use the same type of sensor but are more sensitive and respond more quickly.CO detectors have an electrochemical cell, which senses carbon monoxide, but not smoke or any other combustion products. The cells do not require much power, so the detectors can be made electrically compatible with ordinary smoke and heat detectors. As fire detectors they are effective but only for certain types of fire. Deep-seated, smouldering fires produce carbon monoxide, which can be detected some distance from the seat of the fire. For this type of fire a CO fire detector will probably operate before a smoke detector. Smoke detectors, however, will almost always give a better response to a fire that has produced a rising plume of smoke. CO fire detectors will give a poor response to flaming fires. Because CO fire detectors work on different principles from smoke detectors, their false alarm behaviour will be different. For example, they will not be affected by steam, dust, or by most cooking fumes. However, because of their high sensitivity, they may false alarm from harmless transient levels of CO produced by gas heaters starting up, or from vehicle exhaust fumes entering through a window. These events would not affect an optical smoke detector.

As always, the detector must be selected for the application, to achieve the best balance between fire detection capability and false alarms. There are some known disadvantages of CO fire detectors. One is that the electrochemical cells at the heart of the detectors have a limited life typically seven years and that they are not failsafe. The detector might be “dead” without this fact being apparent. For this reason a means of checking the CO cell has been incorporated. Another clear disadvantage is the poor response to many types of fire, especially life threatening flaming fires.

Multi sensor detector

This detector combines inputs from optical and heat sensors and processes them using a sophisticated algorithm. When polled by the control panel it returns an analogue count which is determined by combined responses from both optical and heat sensors. They are designed to be sensitive to a wide range of fires and may be used in place of an ionization detector in many instances.

Operating principles

Signals from the optical smoke chamber and temperature sensor are independent, and represent the smoke level and air temperature respectively in the vicinity of the detector; the detector's micro controller processes both signals. The temperature signal processing extracts only rate of rise information for combination with the smoke signal. The detector will not respond to slow increases in temperature but a large sudden change can cause an alarm without presence of smoke, if sustained for 20 seconds. The processing algorithms in the multi-sensor incorporate drift compensation.

Points to consider

- Open or closed circuit
- Fault monitored circuit
- System voltage
- Surface or flush mounting
- Detector operated indicator
- Two or three-wire system
- Quiescent current demand
- Smoke detector location
- Spare detector heads

Manual Call Points

A Break Glass Call Point is a device which enables personnel to raise the alarm by breaking the frangible element on the fascia. They should be mounted 1.4m from the floor and sited where they can be easily seen. Manual Call Points should be sited on the floor landings of stairways and at exits to open air. It should be noted that Call Points should be fitted on the floor side of an access door to a staircase so the floor of origin is indicated at the Control Panel. Extra points should be sited, where necessary, so that the greatest travel distance from any point in the building to the nearest call point does not exceed 30m. A greater number of Call Points may be needed in high risk areas or if the occupants are likely to be slow in movement. Flameproof call points are available, also handle operated points for use in areas where broken glass may cause a hazard.

Points to consider

- Open circuit, closed circuit, fault monitored circuit
- Weatherproof, internal location
- Spare breakable material
- Contact rating suitable for load under alarm conditions
- Special call points for flameproof or special hazard areas
- Hammer for call points with breakable front plates

Alarm Sounders

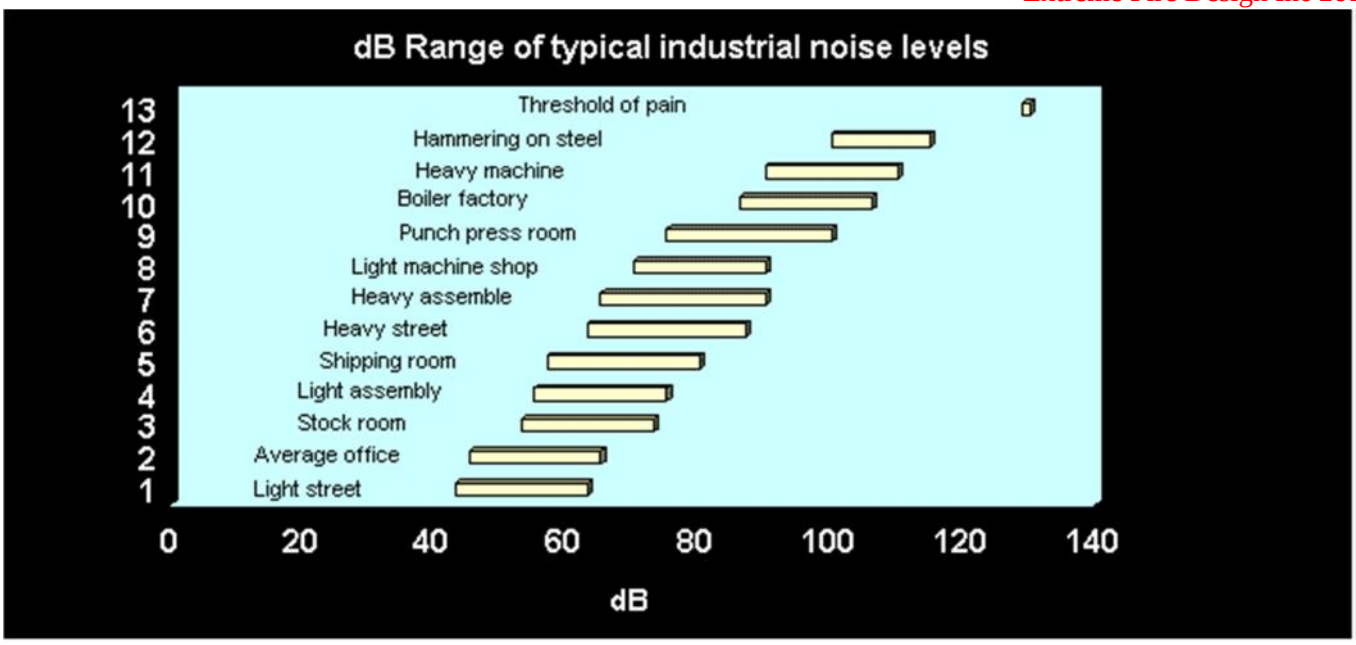
Many types of alarm sounders are available and include:

1. Dome bells – operating mechanism contained within the bell.
2. Bells with operating mechanism external to the bell.
3. Electronic solid state sounders with mono or multi tone output normally in the range of 800 – 1000 Hz.
4. Small sirens operating in the range of 1,200 – 1,700 Hz.
5. Sirens ranging widely in size from 0.17kw to 11kW generally operating in the frequency range of 400 – 800 Hz.
6. Horns operating in the range of 300 – 400 Hz and either motor or pneumatic operations.

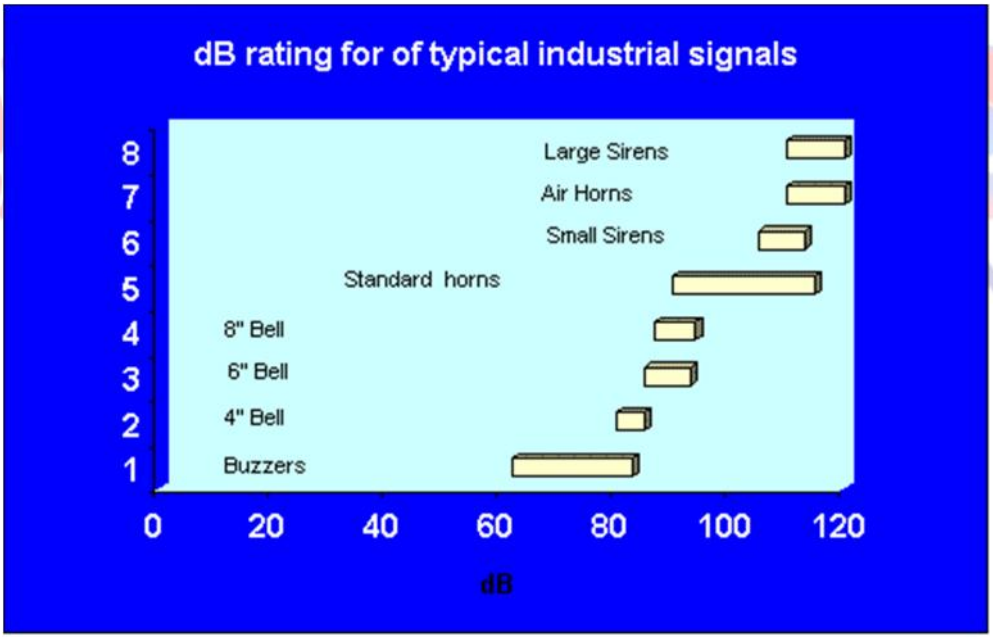
The following figures gives a broad indication of the sound levels of the various alarm sounders. Also indicated are typical sound levels for various industrial and commercial situations. An alarm noise level of not less than 5 decibels above ambient should be provided in general areas for adequate audibility but in sleeping areas a minimum level in the order of 65 decibels and 75 decibels at a bed head to wake sleeping occupants. It should be noted that most dome hells are intended for use with flush conduit or wiring systems. For surface wiring or conduit installations surface mounting adaptor boxes are normally required. Generally bells, electronic sounders and small sirens are available for use with 6, 12, 24 and 48V D.C. Sirens are normally operated at mains voltage, single or three-phase depending on the motor rating. Outdoor sirens should be fitted with heaters and thermostats to protect against low temperature conditions. Public address systems may be used for alarms, and visual signals may be used in special circumstances.

Points to consider

- Operating voltage
- Installation with surface or flush conduit system
- Internal or weather-proof installations
- Bell gong size
- Colour
- Motor rating of sirens, note some sirens are rated for continuous duty whilst others are rated for limited time periods.
- Television interference suppression



Whisper at 1m = 30dB
Casual conversation at 1m = 65dB
Threshold of pain = 130dB



Power Units

Two power supplies are required i.e. mains and battery and these are normally built into the Fire Alarm Control Panel. Standby batteries must allow the system to operate without mains for 24 hours longer than the building is likely to be unoccupied and then support the sounders for an additional half hour. If the mains supply is supported by an emergency generator then six hours standby plus half an hour alarm load is sufficient. All modern Fire Alarm Systems are 24 volts. On the medium and larger sized Fire Alarm Systems, the standby batteries will often not fit within the Control Panel.

Where standby batteries are contained within a separate housing, then this housing must be as close as possible to the main Fire Alarm Control Panel. If the power supply or battery housing is located more than 10 metres from the main Fire Alarm Control Panel then serious volt drop problems can arise. Standby batteries are invariably of the sealed lead acid variety. Use of Nickel Cadmium Batteries is not cost effective and automotive batteries must not be fitted.

Points to consider

- System voltage
- Battery charger output
- Battery capacity
- Indication of battery and/or mains supply failure
- Secondary battery exclusive to fire protection system
- Where system voltage exceeds extra-low voltage compliance

Self-Contained Fire Alarm Units

These units normally incorporate break glass contact, fire alarm sounder, battery and charger. The units are suitable for small hotels, shops, guest houses etc. A single sounder can be expected to give a 3 hour alarm. This reduces to one hour when three additional 6 bells are installed. Self-contained units incorporating smoke detectors are also available, they normally include visual and audible indicators of the circuit and power supply faults in accordance with the British Standard.

Points to consider

- Open, closed or fault monitored circuit
- Smoke detectors to be incorporated
- Operating voltage
- Number of additional bells
- Resistance of connecting cables
- Spare glasses for contact
- Mains supply connection for unit
- Spare cartridge fuses

Wiring and Installation

Recommendations as to suitable types of wiring and cables are included in the British Standard together with minimum conductor sizes, it also indicates suitable cable types for monitored or non-monitored circuits according to the type of installation. The Institution of Electrical Engineers Regulations for the Electrical Equipment of Buildings Regulations refers to the necessary segregation of fire alarm circuit wiring. Provision should be made for end line devices to be fitted, where necessary, for line fault monitoring.

Inspection and Servicing

This information is provided for the general guidance of fire detection and fire alarm system users. As it is a summary, it omits much of the information included in BS5839 part 1. It is therefore not intended to be a replacement for the detailed recommendations included within British Standard.

Routine testing by the user

It is vital for a regular test to be undertaken to ensure that there has not been a major failure of the entire fire detection and fire alarm system that may otherwise go unnoticed.

Weekly tests

- Test a manual call point during working hours to cheek that the control panel and alarm sounders operate satisfactorily
- Each week, a different manual call point should be tested
- Voice alarm systems should be tested weekly in accordance with BS5839 Part 8. If the system is connected to an Alarm Receiving Centre (ARC) for calling the fire brigade, it is very important that the ARC is notified before testing commences and when it is complete

Monthly tests

- Any automatically started generator used for the fire detection and fire alarm system should be tested
- Any vented batteries used as a standby power supply for the fire detection and fire alarm system inspected

Inspection and Servicing by a competent person

The inspection and servicing should be undertaken by organisations with the appropriate competence. This can be assured by the use of organisations that are third party certificated, by a UKAS accredited certification body, specifically to carry out inspection and servicing of fire detection and fire alarm systems.

Periodic inspection and testing

- The period between visits to undertake inspection and service should he based upon a risk assessment but the maximum period between visits should not exceed six months.
- The log book should be inspected
- A visual inspection should be made to check whether structural or occupancy changes have been made that require changes to the fire detection and fire alarm system.
- False alarm records should be checked and relevant action taken if necessary
- Batteries should be checked and tested
- Control panel functions should be checked and tested
- Fire alarm devices should be tested
- All fault indicators and circuits should be tested and checked
- Printers should be tested
- Other checks and tests recommended by the manufacturer should be carried out
- Outstanding defects should be reported and the logbook completed and servicing certificate issued.
- The recommended period between successive inspection and servicing visits should not exceed six months.

Quarterly inspection of vented batteries

- Vented batteries should be examined by a person with relevant competence and should be topped up if necessary

Inspection and test of a system over a 12 month period

- The switch mechanism of every manual call point should be tested
- Every automatic fire detector should be examined and functionally tested. This includes, but is not limited to; smoke detectors, resettable heat detectors, optical beam smoke detectors, aspirating fire detection systems, carbon monoxide fire detectors and flame detectors
- All fire alarm devices (both visual and audible) should be tested
- Certain filament lamps should be replaced
- Visual inspection of readily accessible cable fixings should be undertaken
- The cause and effect programme should be checked
- The standby power supply capacity should be checked
- Other annual checks and tests recommended by the system component manufacturers should be undertaken
- Outstanding defects should be reported and the servicing certificate issued.
- As this is labour-intensive servicing, it is recommended that the work can be spread over two or more service visits during each twelve-month period

Non-routine attention

The arrangements in the above section, inspection and servicing are intended to maintain the system in operation under normal circumstances. However, from time to time, the fire alarm system is likely to require non-routine attention, including special maintenance. Non-routine maintenance includes:

- special inspection of an existing fire alarm system when a new servicing organization takes over servicing the system;
- repair of faults or damage;
- modification to take account of extensions, alterations, changes in occupancy or false alarms;
- action to address an unacceptable rate of false alarms;
- inspection and test of the system following a fire.

For instance recommendations on unacceptable rate of false alarms:

Any false alarm investigation and subsequent modifications to the system takes into account the guidance provided in BS5839. Any organisations undertaking false alarm investigations and related remedial work should be able to demonstrate their competence to undertake such work. This section contains comprehensive information on all aspects of limitation of false alarms.

The measures to limit false alarms are divided into eight groups:

- Siting and selection of manual call points
- Selection and siting of automatic fire detectors
- Selection of system type
- Protection against electromagnetic interference
- Performance monitoring of newly commissioned systems
- Filtering measures
- System management
- Regular servicing and maintenance

British Standards Relating to Fire Alarms

The appropriate British standards for installation of a fire alarm in non-domestic premises is **BS 5839-1:2012** and **BS 5839-6:2013** for the design, installation and maintenance of fire detection and fire alarm systems in dwellings. A number of British Standards relating to fire alarm systems follows.